The EuroNanoForum 2009 international nanotechnology conference and exhibition on "Nanotechnology for Sustainable Economy" is organized by the Technology Centre of the Academy of Sciences of the Czech Republic with the support of the European Commission and the Ministry of Education, Youth and Sports of the Czech Republic, as an official event of the Czech Presidency of the Council of the European Union.

The event addresses the contribution and challenges of nanotechnology research for a sustainable development of European industry and society, such as the need for reduction in carbon emissions and fossil fuels dependence, the substantial increase in energy demand and material production sustainability and efficiency, pollution control, clean water management and sustainable quality of life of the European citizen. In this domain, nanotechnology presents many opportunities and challenges that have to be analyzed at international level through a safe, responsible and integrated approach, as first presented by the ENF2003 conference.

The information gathered in these Proceedings provides an overview of the state-of-the art in the key application areas of nanotechnology, presented by selected international researchers and industrial experts coming from diverse fields of science and technology, to contribute to the definition of a European nanotechnology strategy after 2009.

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EuroNanoForum 2009
Nanotechnology for Sustainable Economy

European and International Forum on Nanotechnology

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Proceedings of the Forum organized by the Technology Centre of the Academy of Sciences of the
Czech Republic, with the support of the Czech Ministry of Education Youth and Sports
and the European Commission, held in Prague on 2-3 June 2009 as an official event
of the Czech Presidency of the Council of the European Union

Directorate-General for Research
2009 Cooperation / Nanosciences, nanotechnologies, materials, and new production technologies EUR 23733
The title of EuroNanoForum 2009, i.e. the "Nanotechnology for sustainable economy" is a big challenge for the time being. When preparation of the EuroNanoForum 2009 started, the very frequent adjective of nanotechnology was, the technology for the 21st century", i.e. the far reaching time horizon signified the role of nanotechnology. However, in a year time the world has changed considerably and the ENF2009 takes place in a time of global financial crisis and economic recession. Hence, we would like to overcome the crisis even by employing the already developed potential of the nanotechnology to radically change the technology portfolios.

This book of abstracts convincingly indicates the rich potential of nanotechnology: the organizers obtained almost four hundred contributions. They cover very broad spectrum of scientific problems, applications of nanotechnology for health, environment, eco and energy efficient industrial production, for energy production and storage and for a number of special industrial sectors. They also tackle about social and environmental safety and deal with "horizontal issues" like education and communication, organizing international research in this particular field etc.

While the current potential of nanotechnology is mapped in this book of abstracts, some important achievements of nanotechnology are demonstrated at the ENF2009 Industrial exhibition, which are however reported in a separate catalogue.

The ENF2009 is organised by the European Commission and the Technology Centre of the Academy of Sciences in the framework of the Czech Republic Presidency of the EU Council.

The organizing parties believe, that the ENF2009 scientific programme with its many plenary discussions and complemented by several concomitant workshops and the industrial exhibition will create a good platform for efficient contributing to find common ground for solving important problems of our time.

Miroslava Kopíková
Minister of Education, Youth and Sports
Parallel Session A3 - Nanotechnology for energy - Nanotechnology for H2 production & Storage: Fuel cells

KL-03 - Nanomaterials for Energy Applications Challenges and prospects
M. Fischer
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The talk starts with an introduction to upcoming challenges in the energy sector. In the view of dwindling fossil and nuclear resources, the use of renewable energy sources becomes increasingly important. However, there are still many unknowns and challenges in the development of new energy technologies.

The talk presents an overview of different nanomaterials that can be used to improve energy efficiency and sustainability. The potential of nanomaterials in different energy applications is discussed, including solar Cells, batteries, and energy storage systems.

At the same time, the development of new energy technologies requires a multidisciplinary approach, and nanotechnology plays a crucial role in this process.

O-06 - Nanostructured Materials for Solid State Hydrogen Storage
K. Taube
IKZ-Forschungszentrum Geesthacht GmbH, Nanotechnology, Geesthacht, Germany

In this talk, the current status of research and development in hydrogen storage is presented, with a focus on nanostructured materials. The talk will cover different types of materials, such as metal hydrides, carbon-based materials, and halide perovskites, and the challenges associated with their development.

From this overview, a general understanding of the current status of research and development in hydrogen storage materials can be gained, and possible future research directions can be identified.

O-08 - ZEOCELL Project: An Innovative Membrane for High Temperature PEMFCs
M. P. Palau
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The PEMFC technology represents one of the most promising opportunities in the field of renewable energy production. However, it has been identified as the main bottleneck in the development of improved and mass manufacturable electric energy storage systems capable of withstanding temperatures in the range of 130-200°C. In this context, a new high-temperature scenario, the most important challenges are related to the electrolyte performance and durability, and also to the fuel cell (cross-over phenomena).

ZEOCELL (http://uma.unizar.es/zeocell) puts forward an innovative concept to bridge the gap between current limitations of commercial available PEMFCs and the previously attained technical targets based on the use of functionalized nanomaterials. Particularly, the synergic combination of micro- and zeolite-type materials, protic ionic liquids (PILs) and conducting polymers (see Figure 1) is proposed to overcome the existing drawbacks.

Figure 1. Individual materials which constitute the three main pillars of ZEOCELL.

Particularly, for the synthesis of microporous materials, the addition of any organic template molecules has been mostly avoided to eliminate the costly calcination or extraction final step. The synthesized PILs, exhibiting decomposition temperatures above 300°C, have revealed enormous possibilities, not only as embedded proton carriers (100 mS/cm and 800 mS/cm at 160°C in dry and saturated conditions, respectively), but also as additional chemicals in the composite membranes fabrication route. Porous conducting polymeric membranes based on poly(2,2-imidazole-5,5-bisazolimidazole) (PBI) with mechanical, chemical and thermal stability up to 200°C have been obtained following two different preparation routes: (i) by the addition of a porogen agent, and (ii) by the inverse phase separation method.

As the electrolyte membrane architecture plays a significant role in order to ensure the best individual properties of each component materials; the herein studied structures (see Figure 2) consist of:

1. A 2-D microstructured polymeric matrix with a controlled thickness (15-150 μm), and 15-75% porosity of ordered (60-500 nm in diameter) or random (500-800 nm) pores sizes filled up with protic ionic liquids,
2. two nanostructured zeolite membranes less than 5 μm in thickness to reduce cross-over and ensure PILs confinement.

Figure 2. Nanostructured electrolyte membrane architecture proposed for PEMFCs high temperature applications.

At this stage of the project, the research efforts are focused on the synthesis of zeolitic layers onto pre-existing porous PBI membranes according to the quoted strategy. However, with the aim of facilitate a mass-scale production, the fabrication of polymer-zeolite-ionic liquids composite membranes in a single step is also attempted.